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Study of N, P, K Nutrient Uptake In Paddy Plant With Total Soil Microbes In Sei Nahodaris Village, Panai Tengah District, Labuhanbatu Regency

Kajian Serapan Hara N, P , K Pada Tanaman Padi Dengan Total Mikroba Tanah Di Desa Sei Nahodaris Kecamatan Panai Tengah Kabupaten Labuhanbatu

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ABSTRACT

The physical, chemical and biological quality of the soil has deteriorated due to the excessive use of chemical fertilizers in paddy fields and neglect to return organic matter to the soil. Populations of soil biota involved in nitrogen fixation and phosphate solubility decrease below this. The purpose of this study was to determine the relationship between rice plants in Satiman, Sei Nahodaris Village, Panai Tengah District, Labuhan Batu Regency, and nutrient uptake of N, P, and K. This research was conducted from September December 2022. In paddy fields, five zigzag sampling points were used to collect rice plant leaves and rhizosphere soil for sampling. Nutrient uptake of N, P, and K, in addition to total microbial, were the parameters analyzed in this study. The direct Pearson correlation method was used to perform the analysis. Analysis showed that sampling point number 5 had the highest microbial population, namely 9.53 x 106.N, P, and K absorbed at an average of 3.51 percent (optimum), 0.27 percent (excess), and 1.306 percent (optimum). The relationship between total soil microbes and N, P, and K uptake is weak and negative (-0.212) with a closeness of 4.50 percent; very high (0.94) and positive with a closeness level of 88 percent; it is moderate and negative; and weak and negative.-0.46), with a similarity level of 21 percent. So it can be said that phosphate solubilizing bacteria dominate soil microbes in rice plants in Sei Nahodaris Village, Panai Tengah District, Labuhan Batu Regency
Keywords: Paddy, uptake of nutrients, total microbes.

ABSTRAK

Kualitas fisik, kimia, dan biologi tanah telah memburuk akibat penggunaan pupuk kimia yang berlebihan di sawah dan lalai mengembalikan bahan organik ke dalam tanah. Tujuan dari penelitian ini adalah untuk mengetahui hubungan antara tanaman padi di Satiman, Desa Sei Nahodaris, Kecamatan Panai Tengah, Kabupaten Labuhan Batu, dan serapan hara N, P, dan K. Penelitian ini dilakukan pada bulan September sampai Desember 2022. .Di sawah, lima titik pengambilan sampel zigzag digunakan untuk mengumpulkan daun tanaman padi dan tanah rizosfer untuk pengambilan sampel. Serapan hara N, P, dan K, selain mikroba total, adalah parameter yang dianalisis dalam penelitian ini. Korelasi Pearson langsung metode yang digunakan untuk melakukan analisis. Analisis menunjukkan bahwa titik pengambilan sampel nomor 5 memiliki populasi mikroba tertinggi, yaitu 9,53 x 106,N, P, dan K terserap pada rata-rata sebesar 3,51 persen (optimum), 0,27 persen (excess), dan 1,306 persen (optimum). Hubungan total mikroba tanah dengan serapan N, P, dan K lemah dan negatif (-0,212) dengan keeratan 4,50 persen; sangat tinggi (0,94) dan positif dengan tingkat kedekatan 88 persen; itu moderat dan negatif; dan lemah dan negatif.-0,46), dengan tingkat kemiripan 21 persen. Jadi, dapat dikatakan bahwa bakteri pelarut fosfat mendominasi mikroba tanah pada tanaman padi di Desa Sei Nahodaris Kecamatan Panai Tengah Kabupaten Labuhan Batu.
Keyword: Padi, Serapan Hara, Total Mikroba.

1. Introduction

One of Indonesia's biggest problems is productivity stability, which is why this is one of the country's biggest problems. In addition, Labuhanbatu Regency is one of the most prominent producing districts in North Sumatra, in addition to the various plantations of oil palm and rubber. According to BPS Labuhanbatu Regency (2002), Panai Hulu District is one of the companies that invests in crops with a cost of 12,231 hectares and a production capacity of 60,930.35 tons on the paddy fields.

According to Wang et al., (2021), the rice field's organic soil is an important indicator. The structure of the organic soil is based on a microorganism and a soil substructure that are more than adequate, resulting in a more efficient and productive production system. However, a survey found that 73% of Indonesian workers had access to high-paying organizational positions (Yaghoubi et al, 2018). Organic returns in the soil and intense chemical fertilizers on the paddy fields are the primary reasons why the biological, physicochemical, and psychological aspects of the soil are in conflict. According to Biswas, (2000), this condition is responsible for the population of soil biota that is influenced by nitrogen and phosphate, poor in nutrients, decreased disease, and wasteful in the care of fertilizers and air.

A microorganism found in the rhizosphere is an example of biological quality.According to Duarah et al., (2011), the number of microorganisms in the rhizosphere is much higher than in the non- rhizosphere.The microorganism activity in the rhizosphere is caused by the exudate that is caused by the plant's body. One example of a microorganism is the rhizosphere, which is active in both the process of feeding the soil, the process of feeding the plant, and as a food source for the root protein.

Sei Nahodaris desert uses a chemical input to produce urea at doses of 75 kilograms per hectare, 100 kilograms per hectare of SP- 36, and 50 kilograms per hectare of KCl. Fertilization was carried out 3 times. the average yield was measured on the 21st day after the harvest (HST) produced 150 kg/ha of urea, while the average yield was measured on the 60th day after the harvest and produced 75 kg/ha of urea and 50 kg/ha of KCl .The process is carried out with the help of either an organic fertilizer or a bodily organ, resulting in a soil macroorganism in the total microbes.

In this case, the cultivation in the Sei Nahodaris desert uses a chemical input to produce urea at doses of 75 kilograms per hectare, 100 kilograms per hectare of SP-36, and 50 kilograms per hectare of KCl. Fertilization was carried out 3 times. the average yield was measured on the 21st day after the harvest produced 150 kg/ha of urea, while the average yield was measured on the 60th day after the harvest and produced 75 kg/ha of urea and 50 kg/ha of Kcl .The process is carried out with the help of either an organic fertilizer or a bodily organ, resulting in a soil macroorganism in the total microbes.

2. Materials And Methods

This research was conducted from September 2022 to Desember 2022. The sampling location was in Sei Nahodaris Village, Panai Tengah District, Labuhanbatu Regency. Analysis of nutrient uptake was carried out at the Socfindo Bangun Bandar laboratory, North Sumatra Province, and the total number of microbes was calculated at the Soil Biology Laboratory, Faculty of Agriculture, University Sumatera Utara.

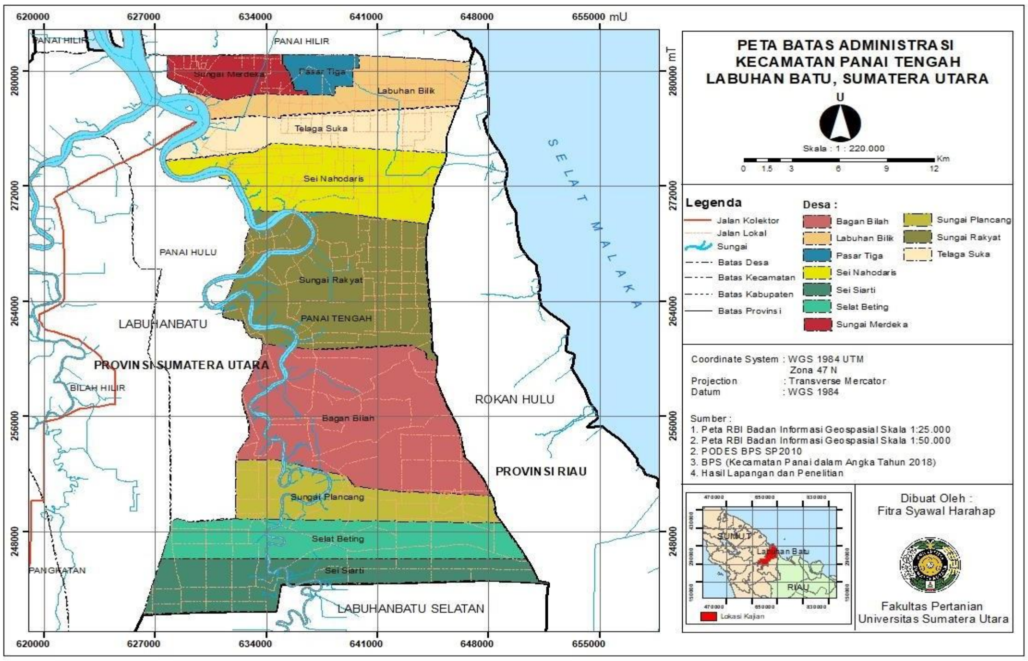

Fig 1. Sei Nahodaris Village, Panai Tengah District, Labuhanbatu Regency

Sampling was carried out by taking leaves and rhizosphere soil of rice plants at 5 sampling points in a zig-zag manner in a rice field area. The rice plants taken as samples are plants that are 2 months old. For every 1 sample, 300 grams of leaves were taken and smeared with alcohol with cotton and then put into a plastic sample and labeled. Furthermore, the rhizosphere soil (around the roots) is taken as much as 100 grams/sample and put in a plastic sample and labeled.

2.1 Research Parameters

Study of Soil Nutrient Parameters (Nitrogen, Phosphorus, Potassium).and total microbes. The sample test results were then analyzed descriptively by comparing the test results with the criteria for nutrient content of rice plant leaves according to Jones (1991), and looking for the relationship with total microbes using Pearson's simple correlation analysis. The interpretation of the coefficients is categorized as follows: r = 0.00 - 0.199 (very low), r = 0.20 - 0.399 (low), r = 0.40 - 0.599 (moderate), r = 0.60- 0.799 (strong), r = 0.80-1 (very strong).

3. Results And Discussion

3.1 Total Microbes

Based on the results of total microbial analysis (Table 1), it can be seen that the highest microbial population is found at sampling point number 5, namely 9.53 x 106. According to Bustami and Rosa (2006) A high microbial population indicates the presence of sufficient organic matter, suitable temperature, sufficient water availability, and favorable soil ecological conditions. According to Hitijahubessy et al. (2016). The density of the microbial population is related to the decomposition and air content of the soil, where the greater the density of soil microbes, to a certain extent can cause faster decomposition of organic matter than a smaller population.

Dewi et al. (2018) stated that in the United States, soil microbes are considered very important, and are used as an indicator in determining soil quality index. The higher the soil microbial population, the higher the biochemical activity in the soil and the higher the soil quality index. Zahrah., (2011) also stated that knowing the population size and microbial activity in a soil can be an indication of soil fertility. Therefore, if you want to increase microbial activity in paddy rice fields in the Sei Nahodaris area, farmers need to add organic matter so that the microbial population is also expected to increase and the soil quality is also getting better.

Tabel 1. Table 1: Results of Total Micrabes

Sample	Coordinating Point		Total Microbes
	N	E	
1	2^{0}28'51",100^0	8'26,18'3,136^0	1,41 x 10^6
2	2^{0}28’51,100^0	8’27’,20,5,m,90^0	1,03 x 10^6
3	2^{0}28'51,100^0	8'27"19,1m,69^0	1,09 x 10^6
4	2^{0}28'51,100^0	8'27,7,4m,86^0	2,30 x 10^6
5	2^{0}28'51,100^0	8'27,7,4m,29^0	9,53 x 10^6

3.2 Nutrient absorption

Based on the results of the analysis it is known that the average yield of N, P and K nutrient uptake is 3.51%, 0.27% and 1.306% respectively. As for B, when the absorption of N, P, K nutrients is compared with the nutrient criteria of rice plants according to Jones (1991), it shows that the status of N, P, and K nutrient uptake is in optimum and excess conditions (Table 2). In addition, with high concentrations, nutrients are more quickly available to plants. Efendi (2016) also stated that inorganic fertilizers are able to provide nutrients in a short time so that plants can meet their nutrient needs properly. This is due to the input of chemical fertilizers (urea, SP36, and KCl) which are continuously given in one growing season 3 times in the paddy rice areas in Sei Nahodaris. This is in accordance with the statement of Akbar (2011), that inorganic fertilizers are able to provide nutrients in higher amounts organic fertilizers.

Table 2. Nutrient uptake of N, P, K

Sample	Coordinate point	Results (%)	Criteria (Jones *et al,* 1991)
	Nutrient uptake Nitrogen		
1	N : 98^{0,}26,18', 03,136^0 , 02^0, 28'51’,100$^{”}$	3.33	Optimum
2	N : 98^{0,}26,18', 03,136^0, 02^0, 28'51’,100$^{”}$	3.72	Excess
3	N : 98^{0,}26,18', 03,136^{0,} 02^0, 28'51’,100$^{”}$	3.78	Excess
4	N : 98^{0,}26,18', 03,136^{0,} 02^0, 28'51’,100$^{”}$	3.25	Optimum
5	N : 98^{0,}26,18', 03,136^0, 02^0, 28'51’,100$^{”}$	3.47	Optimum
	Average	**3.51**	**Optimum**
	Nutrient uptake Fosfor		
1	N : 98^{0,}26,18', 03,136^0 , 02^0, 28'51’,100$^{”}$	0.25	Excess
2	N : 98^{0,}26,18', 03,136^0, 02^0, 28'51’,100$^{”}$	0.25	Excess
3	N : 98^{0,}26,18', 03,136^{0,} 02^0, 28'51’,100$^{”}$	0.15	Optimum
4	N : 98^{0,}26,18', 03,136^{0,} 02^0, 28'51’,100$^{”}$	0.2	Excess
5	N : 98^{0,}26,18', 03,136^0, 02^0, 28'51’,100$^{”}$	0.5	Excess
	Average	**0,27**	**Excess**
	Nutrient uptake Kalium		
1	N : 98^{0,}26,18', 03,136^0 , 02^0, 28'51’,100$^{”}$	1.54	Optimum
2	N : 98^{0,}26,18', 03,136^0, 02^0, 28'51’,100$^{”}$	1.55	Optimum
3	N : 98^{0,}26,18', 03,136^{0,} 02^0, 28'51’,100$^{”}$	1.15	Optimum
4	N : 98^{0,}26,18', 03,136^{0,} 02^0, 28'51’,100$^{”}$	1.14	Optimum
5	N : 98^{0,}26,18', 03,136^0, 02^0, 28'51’,100$^{”}$	1.15	Optimum
	Average	**1,306**	**Optimum**

According Yu et al. (2012), fertilizer application must be carried out correctly and in accordance with the recommended concentration, as too much fertilizer can poison plants. According to Kusmanto (2010), fertilizer must be administered in an amount that is sufficient to meet the needs of plants without being excessive or insufficient.If you apply too much fertilizer, the soil solution will be too concentrated, which could poison the plants. On the other hand, if you apply too little fertilizer, the effects on the plants may not be apparent. Guan et al. (2011), assert that plants deficient in nitrogen, phosphorus, and potassium will encounter limitations in growth and production both in terms of quantity, quality, and continuity. When plants receive an excessive amount of fertilizer, their growth will become bushy and dominantly vegetative, resulting in little fruit.

3.3 Total Microbial Relationship with Nitrogen Nutrient Uptake

Based on the results of the correlation test, it was known that the relationship between total microbes and nitrogen nutrient uptake has a low and negative correlation (-0.212). The low correlation indicates that total microbes have little effect on the level of nitrogen uptake in rice plants in the paddy fields of Sei Nahodaris village. The T level of closeness is 4.50%, which states that the relationship between the two variables is not strong, and the negative sign indicates that the relationship is inversely proportional. Based on these results, it is assumed that the microbial population found in the soil in the paddy fields of Sei Nahodaris village is very small and contains nitrogen-fixing bacteria. Naher et al., (2016) say that nitrogen is one of the most common biomolecular elements, but not always in a form that can be used in a living organism. According to Firman et al., (2017), volatilization, denitrification, and leaching all result in significant loss of nitrogen.The goal of soil organisms, for example, N-fixing microorganisms, is supposed to assist with providing N in the dirt through nitrogen obsession and fixing.According to Hs and Tambingsila (2014), nitrogen must be fixed by a group of prokaryotes that produce complex enzymes like nitrogenase, which can convert dinitrogen from the air into ammonium.According to Tnado (2019), there is a group of N-fixing bacteria both symbiotic and non-symbiotic—whose enrichment necessitates the addition of organic matter to the soil.

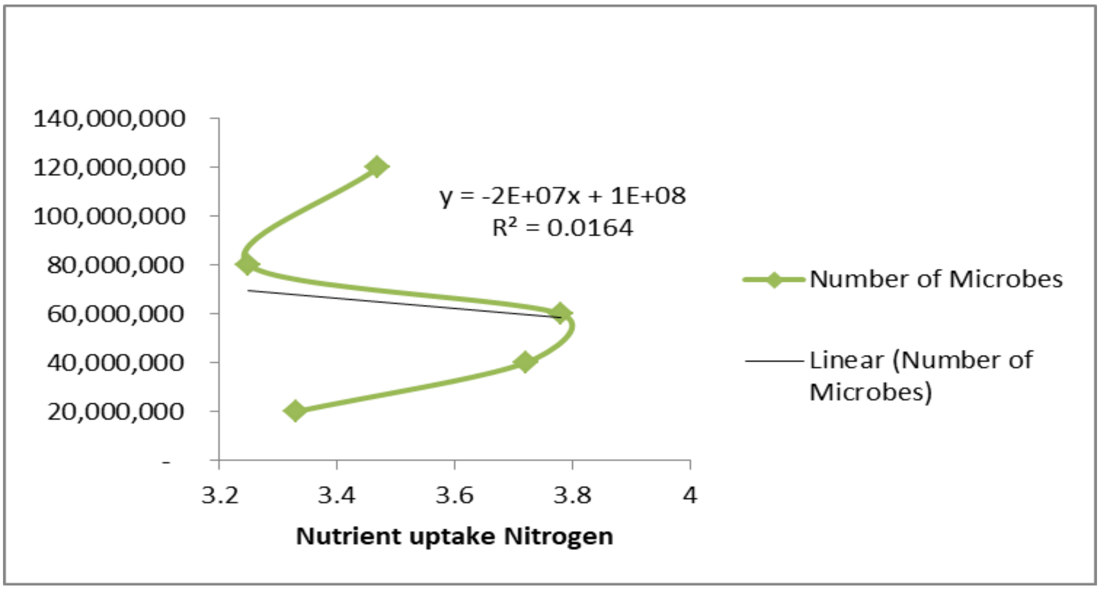

Figure 1. The relationship between total microbes and nitrogen nutrient uptake

3.3.1 Relationship of Total Microbes with Phosphorus Nutrient Uptake

Based on the results of the correlation test, it is known that the relationship between total microbes and phosphorus nutrient absorption has a positive correlation of 0.94 and a very high correlation.There was a strong correlation between total microbes and the amount of phosphorus nutrient uptake by rice plants in Sei Nahodaris village's paddy fields.The rate of phosphorus nutrient uptake is inversely proportional to the microbial count.The fact that the T level of closeness is 88% indicates that there is a strong relationship between the two variables.Because of this, it is reasonable to assume that the phosphate-solubilizing bacteria or mycorrhizae, which are capable of increasing nutrient P uptake, dominate the total soil microbes in the paddy fields of Sei Nahodaris village.The chart of the relationship is introduced in Figure 2 underneath.

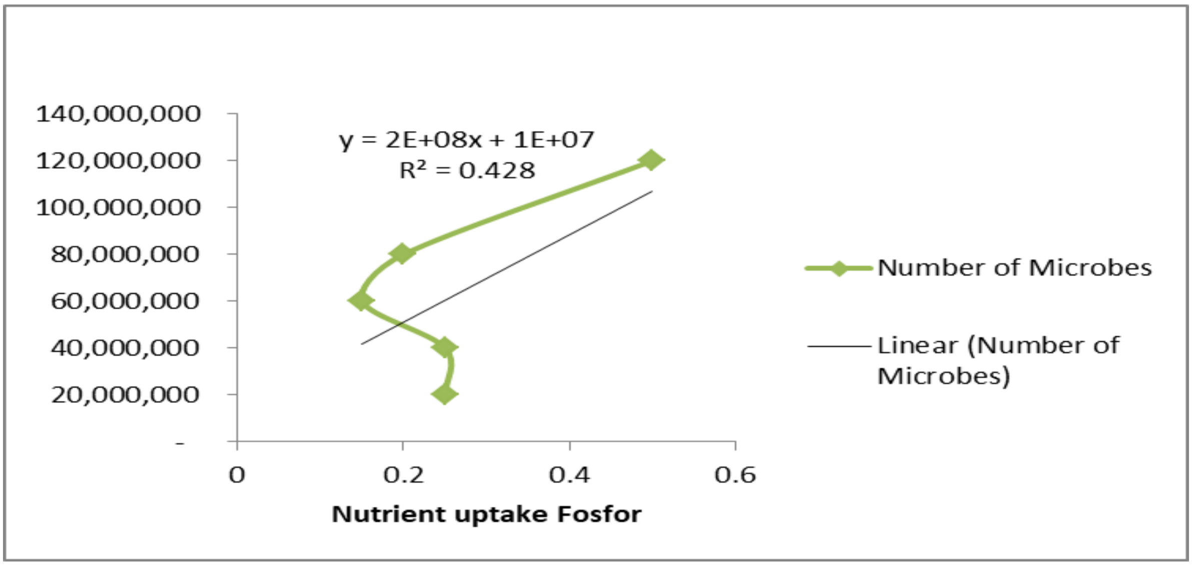

Figure 2. The relationship between total microbes and phosphorus nutrient uptake

As much as 70% of phosphate in soil, according to Patti (2018), is insoluble; however, when phosphate solubilizing bacteria are present, they convert insoluble phosphate into organic acids like formic acid, acetic acid, propionate, lactic acid, glycolate, fumarate, and succinate, which help plants absorb phosphate (Zahrah.,2010).Another soil microbe, mycorrhiza, can increase the availability of and uptake of P by plants by increasing root reach in the absorption of immobile nutrients like P in the soil (Kaya E, 2018).

3.3.2 Relationship of Total Microbes with Potassium Nutrient Uptake

It is known from the correlation test that there is a moderately negative correlation (-0.46) between total microbes and potassium nutrient uptake.According to the moderate correlation, total microbes have a moderate impact on the amount of potassium nutrient uptake by rice plants in Sei Nahodaris village's paddy fields.The two variables have a moderate relationship, as indicated by the T level of closeness of 21%.In view of this, it very well may be expected that the microbial populace in this paddy field contains moderate measures of potassium solubilizing microscopic organisms.The relationship graph is shown in Figure 3 below.

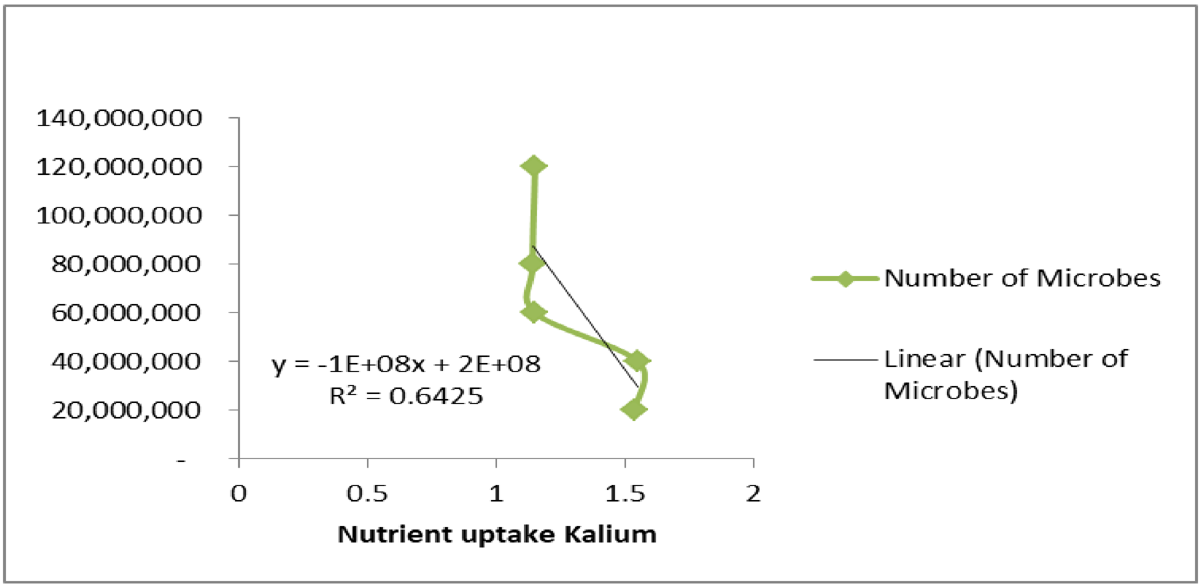

Figure 3. Relationship between total microbes and potassium nutrient uptake

Soplanit and Nukuhaly (2018) says that potassium is the element in the soil with the most total amount out of all the elements, but only about 2% of it can be used by plants and absorbed. The washing process, which removes potassium from the soil, and the high level of potassium fixation account for the low availability of potassium. Microorganisms that dissolve potassium are needed to make nutrients Kasno et al. (2008), potassium solubilizing bacteria can produce organic acids like acetate, citrate, and oxalate from a mineral to produce potassium.These organic acids will also form complex compounds when they interact with other cations like Ca, Al, and Fe.

4. Conclusion

On the basis of the analysis's findings, it is possible to draw the conclusion that sampling point number 5, which measured 9.53 x 106, contained the most microbial population.The average levels of N, P, and K nutrient absorption were 3.51% (optimum), 0.27 percent (excess), and 1.306% (optimum).With a closeness level of 4.50 percent, the correlation between total microbes and nitrogen nutrient uptake is negative and low (-0.212).With a closeness level of 88%, there is a positive correlation of 0.94 between total microbes and phosphorus nutrient uptake.With a closeness of 21%, the correlation between total microbes and potassium nutrient uptake was moderately negative (-0.46)

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